

TAYLOR (H.L.)

The Treatment of Pes Equino-  
Varus by Continuous  
Leverage

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HENRY LING TAYLOR, M.D.

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*Reprinted from the MEDICAL RECORD, March 8, 1890*

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## THE TREATMENT OF PES EQUINO-VARUS BY CONTINUOUS LEVERAGE.<sup>1</sup>

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IN congenital equino-varus we probably have the result of arrested development of the foot, whether due, as Dr. H. W. Berg<sup>2</sup> believes, to failure of the thigh to rotate in, or to other causes. In this well-known deformity the heel is drawn upward and inward, and the foot is bent inward upon itself, and rotated toward the internal malleolus. These elements are present in varying degree in the different cases. Anatomical and clinical observation have shown that all the tissues, and not the muscles alone, are shortened and compressed on the concave side, lengthened and expanded on the convex side. The bony and ligamentous structures especially are shortened, narrowed, wedged, or displaced as compared to the normal foot, because growth has taken place in an abnormal position. In some specimens which have been examined it is noted that deformity persisted after all the tendons had been cut.<sup>3</sup>

It is thus apparent that the problem presented is to remould the foot, by artificially supplying the forces which are deficient. When contracted and compressed regions are relieved of pressure by the stretching process, their

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<sup>1</sup> Read by title at the meeting of the American Orthopædic Association, Boston, September, 1889, and in full at the Orthopædic Section of the New York Academy of Medicine, November 15, 1889.

<sup>2</sup> Archives of Medicine, New York, December, 1882.

<sup>3</sup> Dr. C. L. Scudder: Boston Medical and Surgical Journal, October 27, 1887, Cases II. and III.



growth will be stimulated toward the natural relations of the parts.

Looking at such a deformed foot from behind, we see that the foot and leg taken together present an irregular curve with the convexity outward. If we are to attempt to reduce this curve it is mechanically advantageous to place our splint, which may be straight from below the knee to the toes, on the inner side of the leg and foot and draw them to it by strapping. This is better than putting the splint on the outer side, because in the former case we have good contact at each end to steady our splint while we are drawing the ankle in, while in the other by any method of strapping the distance between the points of firm contact is much shorter, and the apparatus consequently less fixed.

Dr. C. Fayette Taylor, when he first began to treat club-foot in 1858 or 1859, saw the mechanical advantage of placing the splint on the inner side of the foot and leg, and has used that method ever since. His early apparatus consisted of a leg-piece and foot-piece pivoted at the ankle, and so arranged that the foot-piece could be set at any angle; a sole-plate was soon added. In the beginning, if there was much equinus, the foot-piece was set with the toe-end dropping so as to make an almost straight splint with the leg-piece; the splint was gradually bent at the shank to rotate the foot out; the tendo Achillis was stretched, and flexion of the ankle was progressively carried on by flexing the foot-piece of the splint and retaining it by a screw. After the foot was inverted and flexed its position was kept by wearing the appliance inside the shoe as a retaining apparatus. The brace was not attached to the shoe, for any attempt to utilize the shoe to hold the foot is disappointing, as it has no precise grasp, and the foot slips and turns inside. In 1867 Dr. Taylor visited many European clinics, among them Mr. Smith's, at the Hospital for Sick Children, Great Ormond Street, London. He found him treating club-foot by bandaging a straight piece of zinc to the inside of the

foot and leg, *having first brought the foot into complete extension*, so that it formed a straight line with the leg. As the foot yielded outward he bent the zinc with his hands to force it still further over, and kept this up until he got an equino-valgus, the lateral deformity being over-corrected, he then cut the tendo Achillis and flexed the foot.<sup>1</sup> Mr. Smith was not an orthopædist, but my father speaks with admiration of the precision of his mechanical sense and the excellence of his work, and acknowledges his in-

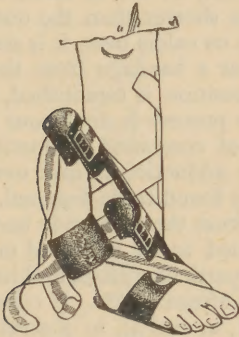


Fig. 1.



Fig. 2.

debtedness to him for the idea of first overcoming the varus before attacking the equinus, which he has adopted and practised ever since. Mr. Smith insisted on the advantage of preserving the tendo Achillis as a counterforce to assist in stretching the plantar ligaments and the structures on the inner side of the foot. The tendon steadies the heel while the forward part of the foot is pushed over, and the plantar ligaments are stretched from the inner side fibre by fibre.

<sup>1</sup> Dr. W. J. Little, in his work on club-foot, published in 1839, had pointed out the advantage of first reducing the varus, as Dr. Shaffer mentioned in the discussion. Dr. Little seems also to have used a form of leverage from the inner side in certain cases.

Up to this time Dr. Taylor had employed tenotomy freely as a step in mechanical treatment, but after adopting the method of first reducing the varus separately, he found that the resistance of the heel cord was so much lessened by the process that it yielded to the mechanical means employed much more readily than under the old plan of reducing both deformities at once, and for the same reason as in the case of the plantar fascia and ligaments. In equino-varus the tendo Achillis is inserted toward the inner side of tuberosity of the os calcis, and the inner border of the tendon is shorter than the outer; by forcing the foot out and the os calcis over, it is stretched fibre by fibre, as when we tear a bandage from the tense edge, and when the valgus position is established, the resistance is diminished. The process is analogous to that employed in the treatment of combined adduction and flexion in hip disease. The adduction is first overcome separately and then flexion is found to be lessened.

The splint, always acting from the inner side and never attached to the shoe, continued to be used and modified to meet the requirements of particular cases, and has been substantially as I show it for fifteen years. It consists, in its commonest form (Figs. 1, 2, and 4), in a steel shank with guarded leg- and ankle-bands pivoted to a foot-piece of thin steel. The foot-piece has a sole-plate, and a side-plate fitted to the inside of the foot; there is a screw stop at the ankle-joint to flex the ankle, and there are straps across the instep which are guarded by a small steel bar. The shank is not usually pivoted directly to the foot-plate but to a steel H-piece which makes an offset from the ankle. The shank of this instrument is easily bent by the hand or by wrenches according to the requirements of the case.

About 1874 he began to apply a three-tailed adhesive plaster to the leg (Fig. 3), a piece of webbing attached to the plaster was buckled to the heel of the apparatus (Fig. 4). This kept the heel from leaving the sole-plate when force was applied, and greatly increased precision.



As the mechanical means became perfected, tenotomy was found less and less useful, even in cases of long standing, or in those that had relapsed after tenotomy, from imperfect mechanical treatment. It was usually found advantageous to preserve the heel tendon as an aid in unfolding the contracted tissues on the bottom and inner side of the foot, and it and the other contracted muscles readily yielded to stretching when force was properly applied, and in the proper order. There is no objection to tenot-

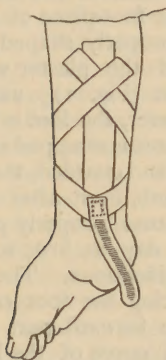


Fig. 3.

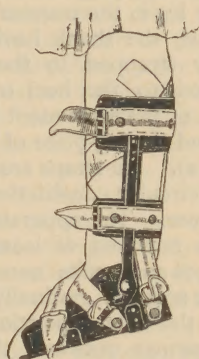


Fig. 4.

omy when it is done with a clear idea of its purpose and limitations, but it cannot be made to usurp the place of systematic mechanical treatment. Much disappointment has been caused by failure to realize that it is only an incident in the treatment of club-foot. After successful tenotomy there is still ligamentous and bony resistance to replacement which, even if for the moment overcome by force, will in time drag the foot back into a deformed position unless mechanical means are used to prevent it, and to hold the foot in position until the hard and soft tissues are remolded and in equilibrium on the two sides. In other words, whether tenotomy is used or not, mechan-

ical treatment is indispensable. A prominent German surgeon, himself a believer in preliminary tenotomy, said to me a couple of years ago : " We in Germany have known for twenty years that tenotomy does not cure club-foot." It is the means employed after the operation that mold the foot into position and retain it, and whether or not a permanent cure is effected will depend on the efficiency of the after-treatment, rather than upon the thoroughness of the tenotomy.

After applying the three-tailed plaster to the inner side of the leg in the manner shown, the foot-piece of the apparatus, the shank having been properly shaped, is securely strapped to the foot, and the plaster webbing buckled to the heel of the splint (Fig. 1) ; using the shank of the instrument now as a lever, the foot is thrown out and the leg-plate of the apparatus is strapped in place (Fig. 2). All straps are so placed and guarded, that there is no circular constriction of the limb, even after continuous use. The apparatus is, of course, properly padded, and is removed at least twice a day at first, to bathe the foot and make necessary modifications. The shank of the splint is gradually bent, forcing the foot over toward the valgus position. As the forward part of the foot swings outward, the original curve of the leg and foot becomes divided into two curves by the displaced heel ; the upper formed by the heel with the tibia, the lower by the heel with the metatarsus. These are in turn directly attacked by our apparatus, thus pushing the foot out and over in the same manner as in the original curve, the inner side of the os calcis being added to the ball of the great toe and inner aspect of the upper end of the tibia as a fixed point of mechanical action, the convexity of the upper curve being drawn to the splint by a strap just above the ankle, that of the lower one by a strap over the cuboid and mediotarsal region.

With this leverage and padding over the inside of the heel, if necessary to increase its force, the os calcis and heel swing over into place. The position of the os calcis

is the key to the situation, and it is not able to resist this direct attack. In fact, it is necessary to be somewhat cautious not to force it too far over, and leave the patient with a permanent valgus.

When the os calcis has been brought into proper position, and the deformity has been changed to an equino-valgus, the ankle is flexed by turning the set screw at the ankle-joint, the heel being prevented from rising by the plaster. During the few weeks that all this is going on it is important that the patient should not put his weight on his foot, as this throws much unnecessary strain on the plaster. When he can place the sole flat on the floor, walking in the splint will assist rather than hinder.

The apparatus must be worn day and night throughout the treatment, so that the foot may never return to the deformed position, and the contracted tissues may always be on the stretch. This moderate continuous stretching is irresistible, and is easily borne by the patient. During the prolonged after-treatment the patient is seen only occasionally, and goes about quite independently in his brace, which is completely concealed by his shoe and stocking. When the tissues of the foot are remolded and stable in their corrected position, all treatment may be discontinued, though it is sometimes better to have the splint worn at night for a time.

The above comprise the essential principles in ordinary cases, but details vary, so that each case from beginning to end is a separate study, and our means must be modified and adapted to suit each individual. We use many forms of foot-brace to suit the peculiarities of the case in hand, but always for varus retain the principle of stretching or moulding by continuous leverage from the inner side of the leg and foot.

Sometimes it is an advantage to run the brace up above the knee in order to get a better purchase on the foot. Once in a while there will be a residual inversion of the thigh after the foot deformity has been corrected. This requires a long apparatus with free knee-joint and hip-

band to evert the thigh. Each mechanical indication must be carefully met as the case progresses.

The acquired varus of infantile paralysis is treated on the same principle, due regard being had in the construction of our apparatus to the condition of the opposing muscles, and of the rest of the limb. Tenotomy is seldom required. In the deformity due to spastic and cerebral palsies tenotomy is more often useful along with mechanical treatment.

The following outlines will give an idea of the results that can be attained by the employment of continuous leverage alone, even after failure with the ordinary methods.

CASE I.—A girl, aged five and a half, came to me from Montreal in March, 1883. She was born with an equinovarus of the right foot, and the heel-cord and one other tendon had been cut by a surgeon at six months, and the tenotomy of the heel-cord had been repeated at ten months. The foot had been put up in plaster and she had had manipulation. At two and a half years she could place the sole on the floor and had begun to walk; from that time till seen she had worn a club-foot shoe. For a year and a half the foot had been rolling over and growing worse; the father stated that it was then (1883) worse than it had ever been.

Examination showed that she walked on a large corn over the cuboid bone turning the foot in (Fig. 5). There was considerable rigidity and the foot could not be brought into position by manipulation.

Continuous leverage was applied and the patient was able to walk on the sole in two weeks, wearing the apparatus.

The foot gained three-fourths of an inch in length and the patient walked about with the shoe over the brace, stepping squarely on the sole of the foot in a month. She continued under treatment two years, and was shown cured (Fig. 6) at the New York Orthopædic Society, April 30, 1885. Since then she has been walking about



freely without support, but has worn the brace at night to prevent relapse. She presents the unusual feature of three-fourths of an inch shortening from retardation of growth in the previously affected leg.

CASE II.—Girl, aged five, Montreal. Brought September 21, 1885. Congenital talipes equino-varus, severe, of left foot. Heel-cord cut at three months; gutta-percha splint till ten months; tenotomy of tendo Achillis repeated then and foot put up in plaster. Scarpa's shoe

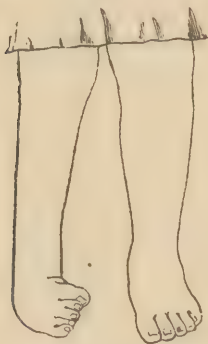


FIG. 5.—March, 1883.



FIG. 6.—November, 1884.

nine months thereafter. Patient learned to walk at nineteen months in ordinary shoe, with foot in deformed position. From two years to four and a half, brace with hip-band. Father states that she has not improved at all since ten months of age.

Examination showed patient walked on corn over cuboid bone, the foot pointing in (Fig. 7). The distal phalanges on right foot are missing and the remaining ones webbed.

Foot came around readily under continuous leverage; patient was walking readily flat upon sole in a few months and was discharged from treatment with deformity cured

(Fig. 8) in two and a half years. She walks flat on foot, turns toe out, and ankle can be flexed beyond right angle.

CASE III.—Boy, aged four, Connecticut. Came in February, 1877. Severe case of double congenital equinovarus. Seven tenotomies at four operations, between third and sixth month; case reported cured, with photographs (Figs. 9 and 10). An earnest attempt was made to hold the feet by mechanical means, but in spite of many kinds of appliances and repeated tenotomies the feet relapsed.



FIG. 7.—September, 1885.



FIG. 8.—October, 1886.

There were altogether eleven etherizations and seventeen tenotomies before the case was brought to Dr. C. Fayette Taylor, at the age of four (Fig. 11). He then presented a severe and typical varus with great rigidity; the feet could not be straightened by manual force. Treatment by continuous leverage was used and the deformity was corrected. Fig. 12 shows their condition in June, 1878. He wore retention apparatus several years, walking about freely, flat on his soles, and the deformity was completely overcome.

He was shown, cured, at the New York Orthopædic

Society, April 30, 1885, walking perfectly flat on the soles of his feet and turning toes out. There was limited motion at the ankle. He had not worn braces for three years.



FIG. 9.—At two months.



FIG. 10.—At fourteen months.



FIG. 11.—At four years.



FIG. 12.—At five years.

Since then, as flexion seemed somewhat diminished, I advised him to wear braces at night to keep the toes from dropping. He has done so, and his feet were, when last

seen, some two years ago, nearly perfect in shape and function, except for the limited ankle motion.

I advocate the method of progressive remoulding of the foot by continuous leverage to correct the faulty moulding of nature on account of its certainty, the directness and precision with which it meets all indications, its freedom from discomfort to and restriction of the patient, the perfection and permanency of its ultimate results.

The treatment of pes equino-varus is not a question of braces or of tenotomy, but of exact apprehension of the indications presented by each case throughout its progress, based upon a critical analysis of the elements involved. As Delore suggestively remarks: "You must convince yourself it is the surgeon, and not the apparatus, that effects the correction."<sup>1</sup>

I emphasize as important practical points:

1. The preservation of the heel-cord as an aid in unfolding the foot.
2. Exact prehension of the foot by means of an apparatus not attached to the shoe, and by plaster applied to the leg.
3. The application of leverage to the inner side of the foot and leg.
4. The reduction, first of the varus deformity, afterward of the equinus.
5. Thorough after-treatment.

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<sup>1</sup> Du Torticolis, etc., *Gaz. Hebdom.*, March, 1878, p. 168.









